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The PRODUCTION OF JOHNSON GRASS FOR HAY AND PASTURAGE

JOHNSON GRASS is adapted to that part of the United States south of latitude 38°. In this region it has occupied the better soils, particularly those of limestone origin, and has made the production of other crops on these soils very difficult and expensive.

Where it already occupies the land, Johnson grass may be profitably utilized as a hay crop; but it does not make a good permanent pasture.

Meadows are more productive if they are plowed up every third or fourth year. Unless the land is cultivated occasionally, other grasses invade the meadows and reduce the yield to a point where hay production is unprofitable.

The demand and the price paid for Johnson hay average less than they should, because of the poor quality of much of the hay offered for sale. Better methods of curing and storing the hay would result in increased profits.

Pasturing Johnson grass weakens it considerably and causes the rootstocks to be produced near the surface, thus making it easier to destroy the grass.

It is not profitable to grow Johnson grass in the Northern States, where it behaves as an annual; and it is not adapted to poor thin soils anywhere.

Johnson grass is a bad weed in cultivated fields in the Cotton Belt, and it is rarely advisable to sow it on land where it is not already present.

This bulletin is a revision of and supersedes Farmers' Bulletin 1476, "Johnson Grass: Its Production for Hay and Pasturage."

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THE PRODUCTION OF JOHNSON GRASS FOR HAY AND PASTURAGE

By H. N. VINALL, *Senior Agronomist, Office of Forage Crops and Diseases, Bureau of Plant Industry,* and M. A. CROSBY, *Assistant Agricultural Economist, Division of Farm Management and Costs, Bureau of Agricultural Economics*

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DESCRIPTION

JOHNSON GRASS[1] is a stout, erect, perennial grass with rather broad leaves in which the middle vein is thickened and white. The panicle, or seed head, is large and open when in bloom (fig. 1), and the spikelets, or seeds, are deciduous, shattering easily when ripe. Besides the fibrous roots customarily associated with grasses, Johnson grass produces numerous underground stems, or rootstocks (fig. 2), which send up shoots from the nodes, or joints, thus producing new plants. It resembles and is closely related botanically to Sudan grass, the chief difference between the two grasses being the presence of rootstocks on the former. These rootstocks on Johnson grass are most abundant at a depth of 6 to 8 inches, but in cultivated fields they often penetrate 18 to 24 inches beneath the surface of the soil. The stems vary in height from 3 to 6 feet, according to the richness of the soil and the abundance of soil moisture. Ordinarily, the stem is not more than three-sixteenths inch in diameter, but on exceptionally vigorous plants it often exceeds that thickness.

ORIGIN AND DISTRIBUTION

Johnson grass is a native of the Mediterranean coast countries of Europe and Africa and of Asia eastward from the Mediterranean through Arabia to India. It was introduced into the United States

[1] *Sorghum halepense* Pers.; *Holcus halepensis* L.

about 1830 by Governor Means, of South Carolina. Ten years later Col. William Johnson, the owner of a large plantation near Selma, Ala., on returning from a visit to South Carolina, brought with him some seed of the grass and sowed it on the rich bottom lands of the Alabama River. It thrived wonderfully in this new locality, and because Colonel Johnson was the first planter to grow the new grass in any great quantity it was named Johnson grass. In South Carolina, however, it was known as Means grass, and that name is still used for it occasionally.

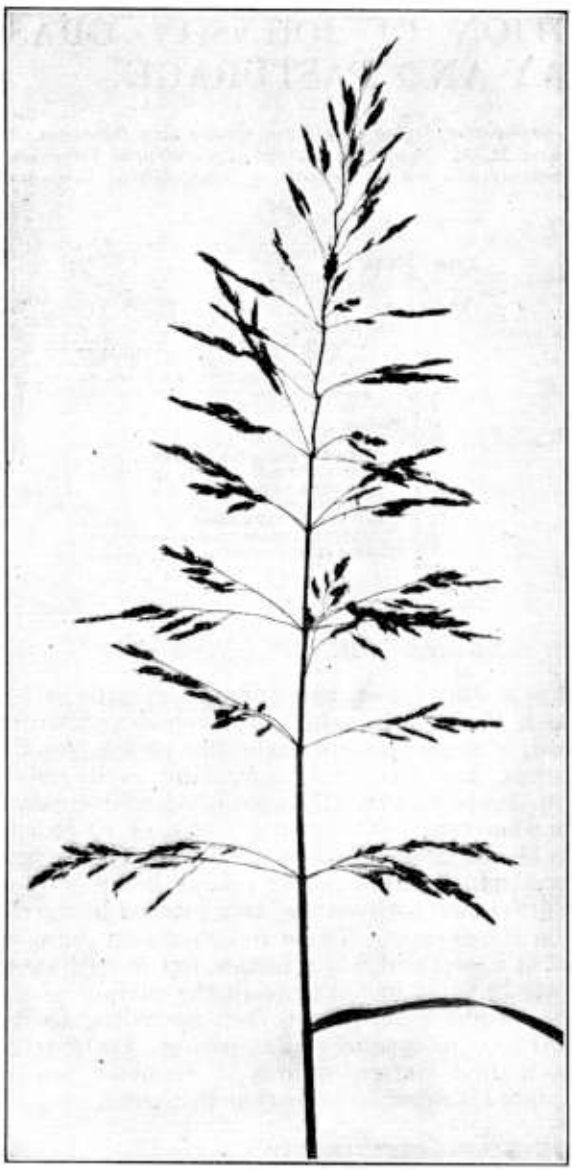

FIGURE 1.—A panicle of Johnson grass just past full bloom

Johnson grass proved exceptionally vigorous in its new home, and it is now rather abundant from the Atlantic coast west to central Texas in that part of the United States south of the thirty-fifth parallel, which marks the southern boundary of Tennessee. It is commonly perennial north to the thirty-eighth parallel, which passes through the northern part of Kentucky and central Missouri, and has persisted in cultivated fields as far north as southern Iowa.[2] In western Texas and in Arizona, New Mexico, and southern California Johnson grass is found chiefly in the irrigated districts; but it extends along

[2] PAMMEL, L. H., and KING, C. M. JOHNSON GRASS AS A WEED IN SOUTHWESTERN IOWA. Iowa Agr. Exp. Sta. Circ. 55, 4 pp., illus. 1919.

the Pacific coast in the river valleys as far north as Oregon and Washington.

On account of its aggressive underground stems, Johnson grass has become a nuisance in the alluvial river bottoms and rich black prairie lands of the Gulf States. It is also classed as a dangerous weed on the irrigated lands of New Mexico, Arizona, and California, where it grows luxuriantly along the irrigation canals. Unless kept from maturing, the seeds are scattered each year over the fields in the irrigation water. The same thing happens also on the river-bottom lands farther east where they are subject to occasional overflows.

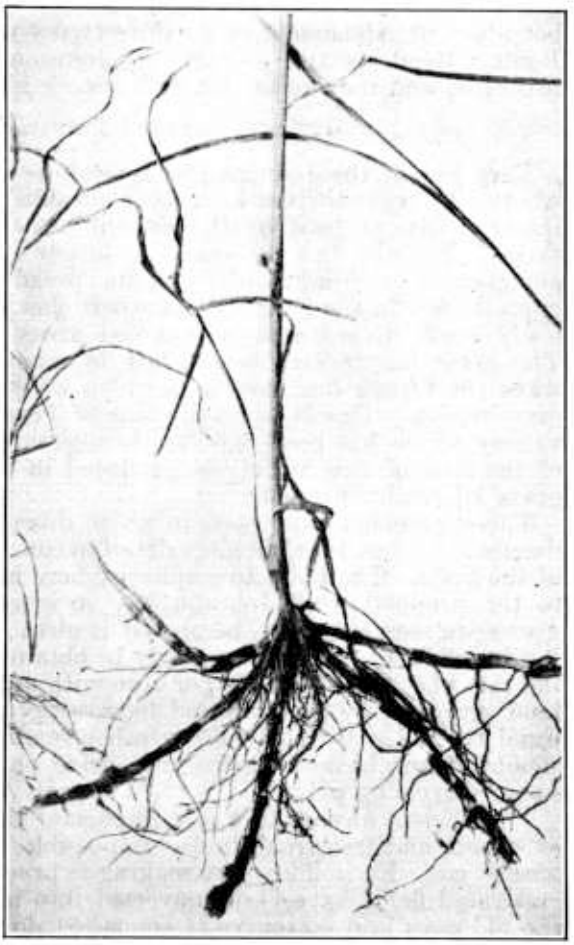

FIGURE 2.—A seedling plant of Johnson grass, showing the early development of underground stems or rhizomes

As indicated, Johnson grass is primarily a rich-land crop. It is always found on the better soils and makes only an indifferent growth on the uplands and poorer soils. On such land the problem of holding it in subjection is possible of solution, and other crops are being grown even where Johnson grass has obtained a foothold. On the river bottoms and rich black soils of the Cotton Belt where Johnson grass thrives, it is expensive to grow cotton or other crops on account of the labor required to keep these crops free from this grass. Under such conditions it is often more profitable to devote the land to the production of Johnson hay.

HAY PRODUCTION

CENTERS OF PRODUCTION

The largest centers of Johnson-hay production, or at least the largest primary markets of this hay in the United States, are

Augusta, Ga., Montgomery and Selma, Ala., Columbus and West Point, Miss., and San Antonio, Waco, and Fort Worth, Tex. Birmingham and Mobile, Ala., New Orleans, La., and Savannah and Atlanta, Ga., are also large marketing centers, but most of the Johnson hay on these markets is imported from a distance. The black prairie soils in the vicinity of Montgomery, Ala., are devoted to Johnson grass almost to the exclusion of cotton and corn, the two major crops of the Gulf States. This is true also of the narrow belt of dark limestone soil as it extends westward to the western boundary of Alabama and northwestward in Mississippi past West Point. Meadows and pastures of Johnson grass occupy much of this land, and the production of livestock is important.

ESTABLISHING A MEADOW

Very few of the Johnson-grass meadows in localities and on soils where the grass thrives have been established by sowing the seed intentionally, at least by the present owners and operators of the farms. For the last 50 years or longer Johnson grass has been abundant on such lands wherever its spread has not met determined opposition. In the river valleys where floods occasionally occur, the seeds are scattered over unoccupied areas by the receding water. The grass has become established in many fields unintentionally, when the farmer has sown oats which were produced in a Johnson-grass region. This is especially true of Texas Red Rustproof oats, a variety which has been popular throughout the Cotton Belt. Most of the seed of this variety is produced in territory where Johnson grass is usually present.

There are many other ways in which this grass is disseminated, but these will be mentioned in more detail in considering the weedy nature of the grass. The point to emphasize here is that in localities suited to the production of Johnson hay it is rarely necessary for the grower to seed the grass, because it is already on his land. If seeding is necessary, a stand can easily be obtained by sowing the seed at the rate of 20 to 30 pounds per acre with an ordinary grain drill on land prepared by plowing and harrowing in the same way that is usual for the seeding of oats or other small grains. Johnson grass should always be sown in the late spring or early summer, as it is a summer-growing plant.

For efficient hay making it is important that the meadows be kept as smooth and free from ditches as possible, and also free of stumps, bushes, etc. Economical hay making is practically impossible where cultivated fields have been converted into meadows without having the old corn and cotton rows smoothed down. A smooth meadow permits of greater efficiency in harvesting through the use of wide-cut mowers and other labor-saving equipment such as tedders and side-delivery rakes, and reduces the danger of breakage of all such machinery. Moreover, on a smooth meadow the amount of scattered bunches of hay left by the rakes will be negligible as compared to that left where the meadow is rough and full of bushes.

MAINTAINING A MEADOW

The productiveness of a Johnson-grass meadow depends primarily upon the character of the soil. On the richest and most suitable soils,

however, the meadows will not maintain their original yields unless they are cultivated at intervals. This cultivation consists in most cases of plowing in the fall or early spring and working the soil down with a disk or a spike-tooth harrow. This kind of cultivation, which would be ruinous to most grasses, merely serves to stimulate the growth of Johnson grass. The thickness of the stand and the quality of the hay are both improved by frequent cultivation of the meadow in this way.

Some hay growers plow their meadows each fall and sow them to winter oats or oats and vetch. The oats and vetch grow during the cool weather of the fall, winter, and spring months. The crop of oats or oats and vetch is cut for hay usually in April or May, and then the Johnson grass begins to grow rapidly and provides two or three good cuttings of hay before cool weather or frost checks its growth in the fall.

This is not, however, the customary way of handling a meadow. Most hay growers believe that plowing every third year is sufficient, and many plow only when their meadows become unproductive or so overrun with other grasses and weeds that the hay is of poor quality. Some meadows have not been plowed for more than 20 years. On most of these the yields are low, and the hay is very largely made up of grasses other than Johnson grass and of weeds. Several such meadows seen in the vicinity of Augusta, Ga., contained not more than 25 per cent of Johnson grass. The remainder of the soil covering was very largely *Paspalum* sp., crabgrass, and Japan clover (Lespedeza). Under such conditions, if the meadow is plowed and seeded to corn for one year, the Johnson grass usually comes back as good as ever. Fertilizer, particularly barnyard manure, applied to the corn crop, has a very beneficial effect on the following hay crops.

On some meadows where a heavy tonnage of hay has been removed annually for a period of years, the yields have gradually declined to such an extent that the production of hay is no longer profitable. This decline in yield appears largely due to the exhaustion of organic matter in the soil, and the usual practice of breaking up and cultivating the meadow is not alone sufficient to maintain production.

One remedy for such a situation is to break or cultivate the meadow early in the spring and plant it to soy beans. This practice serves to thicken the stand of Johnson grass; a valuable crop of legume hay is obtained, and the tonnage of later cuttings of Johnson grass is increased. Some producers are keeping their annual production up to 3 tons or more to the acre by following this practice. Another practice is to sow the meadow to sweet clover. Mixtures of Johnson grass and sweet clover should be cut when the sweet clover is just beginning to bud, in order to make a palatable hay of good quality. There is usually a good demand for this mixed hay from dairy farmers.

On thin upland the soil is often too poor to produce profitable yields, even though a good stand of Johnson grass is maintained. Owners of such land must increase the soil fertility or be content with low yields. In the Black Prairie belt a good method of improving such meadows is to sow them to sweet clover and allow both Johnson grass and clover to remain uncut for two years, then turn the whole mass of vegetation under. This usually results in a tremendous increase in the yield of Johnson hay.

On some livestock farms the damaged and unmarketable hay is fed to livestock on the thin land. The droppings from the cattle, together with the unconsumed hay that is left on the land, quickly restore the productiveness of the soil.

Pasturing the meadows during the winter is resorted to regularly in the irrigated districts near San Antonio, Tex. The unirrigated meadows of Texas, Alabama, and Mississippi are sometimes pastured lightly, but all agree that pasturing at any time injures the grass and lowers the yield of hay. The injury is much less on the irrigated meadows. Johnson grass gives place to other grasses when pastured heavily; and hay growers should not attempt to pasture large numbers of cattle on their meadows, unless they wish to destroy the Johnson grass and discontinue hay production. Pasturing in the States east of Texas usually results in the presence of other grasses, such as Bermuda grass and Dallis grass, which are better than Johnson grass for pasturage but much less desirable for hay.

IRRIGATING A MEADOW

The irrigation of Johnson grass is practiced extensively in the vicinity of San Antonio, Tex. The first cutting on these irrigated meadows is taken off late in April or early in May. (Fig. 3.) If this cutting is weedy, it is raked up and pushed into the irrigation ditches, where it is burned. The field is then irrigated unless rain has been abundant, and new growth starts immediately, so that the second cutting is usually ready early in July. The field is irrigated again as soon as the hay is off, and the growth is rapid, the third cutting being ready by August 15 to 20. This cutting is usually equal to the second in quantity; and ordinarily, as there is very little rain at this time of the year to interfere with curing, the quality of the hay is excellent. Another irrigation is then given the land, and a fourth cutting is ready by the last of September or early in October. This usually ends the haying season, as frost normally occurs at San Antonio in October.

Irrigation water at San Antonio costs the grower $3 an acre a year. There is an additional expense, however, in the labor required to apply the water; so that there remains but little profit unless the hay brings over $10 a ton, even though the yields on irrigated land are nearly double those obtained on unirrigated fields.

The growth of the grass on the irrigated fields is much more nearly uniform and the stand usually better than on unirrigated meadows. This uniformity in growth and stand results in a higher grade of hay, because the time for cutting can be regulated to better advantage. The unirrigated meadows often present a ragged appearance, some spots in the fields showing a good stand and luxuriant growth, while the remainder is occupied by weeds and other grasses or by Johnson grass which has made only an indifferent growth.

WHEN TO CUT JOHNSON GRASS FOR HAY

Most producers of Johnson hay try to cut their crop before any seed has matured and usually just before the heads emerge from the boot. A strict application of this rule as to time of cutting is not always possible because of the uneven growth on unirrigated

meadows. In such meadows there will usually be plants or groups of plants that have sent up seed stalks a week or more in advance of the general field. These early or vigorous plants mature seed by the time most of those in the field are forming heads. It is this feature of Johnson hay which causes so much condemnation among buyers and feeders. Viable seed scattered about the country in shipping or feeding the hay is often the means of introducing it into a locality where it is not wanted.

Other things being equal, the quality of Johnson hay depends largely on the stage of maturity at which it is cut. Most of the extensive producers begin cutting when the grass is in the "boot" or even before this stage is reached, and if possible complete the mowing before any of the heads have formed seed. On account of its high moisture content, Johnson grass cut in the "boot" is usually more difficult to cure than when cut at a more advanced stage of

FIGURE 3.—The first cutting of Johnson hay on an irrigated farm near San Antonio, Tex., April 25, 1925

maturity, but when properly handled it makes the most desirable hay as regards both feeding value and market grade. If the cutting is delayed until the grass is fully headed out the hay is likely to be off color, woody, and unpalatable, and some of the plants will have matured seed.

CUTTING AND CURING THE HAY

Johnson grass should be cut at the time of day that will permit of its being cured and put into cocks, or stacks, or baled with the least possible exposure to dew, hot sunshine, or showers. Mowing practices vary considerably with different producers, and the more successful hay men change their methods to fit prevailing weather conditions. It is generally considered best not to mow while the grass is wet from dew or rain, but those who are handling a large acreage, and whose haying operations are almost continuous from spring until fall, can

not always follow this rule. Such producers in Mississippi, Alabama, and Georgia usually find it necessary to keep the mowers going most of the day while hay-making weather prevails. Probably the most common practice with the less extensive producers is to start the mowers as soon as the dew is off in the morning and continue until night or until the required quantity has been cut. Some make a practice of mowing only in the afternoon, and still others start mowing about 4 o'clock in the afternoon, and continue mowing the following morning after the dew is off until about 10 o'clock. This latter practice is followed so that all hay cut may be raked into windrows in the afternoon of the second day and before any dew falls on the cured hay while it is in the swath. The more efficient producers usually have their work so organized that only so much hay is cut each day as can be baled, cocked, or stacked on the day following.

The methods of curing vary somewhat according to the locality and the incidental climate, but it is fully recognized by the best hay growers in each locality that Johnson grass must be well cured before it is baled; otherwise it is sure to heat and spoil in storage. The danger of injury in this way is greater in the case of this grass than with other hay grasses, because of its coarse stems. Notwithstanding this general knowledge of the need of thoroughly curing Johnson grass before baling, many growers hasten the process (1) in order to escape possible rains and (2) because the hay weighs more when it is not allowed to cure perfectly. Rushing the hay to market is practiced more by the small grower than by the large producer, who has a deeper interest in maintaining good prices and providing a regular market for his future crops.

Rapid, even, and thorough curing is essential to the making of a hay of high quality. Hay that is left in the swath exposed to two or three heavy dews or an occasional shower loses quality through bleaching or weather staining, consequently the more quickly the hay can be cured sufficiently for baling, cocking, or stacking, the better the quality will be.

The first cutting of Johnson grass is usually more difficult to cure than later cuttings, although frequently there is not much difference between the first and second cuttings in this respect, especially where the stand is heavy. The first and second cuttings are generally made in June and July, and during this period there is normally considerable rainfall. For this reason there is likely to be more moisture in the ground, the grass is coarser, heavier, and more sappy, and consequently more time is required for curing than is the case with cuttings made later in the season when the ground is dry and the growth of grass lighter and finer stemmed.

When hay in the swath has been wet by a heavy dew or a shower, a tedder can be used to "kick" the moisture off of the hay, thus hastening the curing and at the same time lessening the damage from bleaching or staining. The use of the side-delivery rake in windrowing the hay or in turning the windrow over will also hasten the curing. Unfortunately, neither the tedder nor the side-delivery rake is in common use in making Johnson hay, partly because their usefulness is not fully understood, and partly because they do not always work in a satisfactory manner where the meadows are rough and uneven. Where these implements are in use their effectiveness in saving labor and speeding up the hay harvest is appreciated.

BALING METHODS

When conditions for curing are favorable, many growers rake the hay which was cut in the forenoon on the afternoon of the day following and place it in bales directly from the windrow on the third day in the afternoon. Baling is done directly from the windrow by the use of a buck or sweep rake. Other growers prefer to allow Johnson hay to go through the sweat in cocks or stacks. When baled from the windrow, it has no opportunity to go through a sweat before baling; sweating then usually takes place in a warehouse at the city market or in a freight car, if it is loaded directly for shipment. Sweating in the tightly compressed bales demands well-cured hay if spoilage is to be avoided.

Windrow baling is more generally practiced by producers with whom hay production is the principal enterprise and whose farms are organized and equipped to handle the crop in an efficient and expeditious manner. Where conditions are favorable and the work is properly done, it is by far the most economical method of handling Johnson hay.

Successful baling of hay from the windrow calls for most careful attention to details and for ability to determine when the hay is cured sufficiently for baling. It also calls for a plentiful supply of labor at harvest time in order that the work may be done as rapidly as possible.

No hard and fast rule can be laid down as a guide for determining when hay in the windrow is cured just right for baling. This is something that can be learned only by careful observation and actual experience, and those who practice baling from the windrow need to be constantly on the alert to avoid baling the hay before it is sufficiently cured. Some who use a side-delivery rake make a practice of first raking the hay into small windrows and then throwing two windrows together the following day. The large windrow thus made is more easily handled with a push rake, and the use of the side-delivery rake in this manner aids materially in curing the hay.

In baling hay from the windrow the usual baling crew consists of one man to feed the press, two men to pitch hay to the feeder, two to tie the bales, and an extra man to take the bales away. The hay is brought from the windrow to the press with push rakes. (Fig. 4.) For efficiency in baling it is necessary that the crew be kept busy at all times and the press working at full capacity. Where the hay is heavy and the haul not too great, one push rake can usually keep the press busy; but with light hay where a large proportion is brought from a considerable distance it is more efficient to use two. The rakes alternate in bringing up hay, each rake dumping its load close to the press just as the load from the other rake is cleaned up. If hay is brought up faster than the press can handle it, part of it will be dumped too far from the press and the pitchers work at a disadvantage, since one man must then pitch to the second who in turn pitches to the feeder. If a tractor is used on the push rake one outfit can usually keep the press working to capacity, as this outfit can deliver a much larger load than a push rake operated with horses or mules.

Hay should never be baled from the windrow while wet with dew, hence the baling crew may frequently lose considerable time in the

morning when there is a heavy dew. Some producers offset this difficulty by bunching enough hay with push rakes in the afternoon to keep the press working the following morning until the dew is off. Where two push rakes are in use one can usually be used part of the time in this manner and thus enable the baling crew to start early in the morning and put in a full day's work.

In baling hay from the stack, if the press is properly placed, the same size of crew is usually required to operate the press as when baling from the windrow, namely, 2 pitchers, 1 feeder, 2 tiers, and 1 man to take the bales away. If the stacks are unusually large or the press not well placed, it is sometimes necessary to use a third man in order to get the hay to the press with regularity and fast enough to keep it working to capacity. In baling stacked hay care should always be taken to remove all stained and damaged hay from the outside of the stack.

FIGURE 4.—The push rake, or buck rake as it is sometimes called, saves much hand labor in baling from the windrow or cock

STORAGE OF BALED HAY

The bales of Johnson hay usually weigh from 60 to 80 pounds, although 100-pound bales are sometimes found in the eastern markets. If the hay has been sold or contracted for prior to cutting, it is ordinarily loaded directly on a truck or a wagon and hauled to the market. At the city or local market the hay may be transferred directly to freight cars or to a warehouse. In either case it is sure to remain for some time in a more or less tightly inclosed place, which tends to hasten and intensify the process of sweating. Unless, therefore, the bales are piled in such a way as to provide at intervals channels for air drainage, considerable damage may ensue from moldy hay.

In storing bales they should be laid on edge with each tier crosswise of the tier below and spaces left for the circulation of air. If any heating is apparent the bales should be repiled in the course of three or four days. Hay baled from the windrow should never be shipped

immediately after baling, for it will be almost certain to heat in transit. It is safest to keep it in storage from 20 to 30 days before it is shipped.

When the hay is not marketed at once it is often the practice in dry regions to pile the bales in the field and protect them with only a thatch of loose hay or leave them entirely unprotected. Some of the larger producers have hay barns in which to store the bales while they await a favorable market. These barns are almost a necessity in humid regions, where the spoilage in case of heavy rains is considerable. Even in dry regions the outer bales are subject to sun bleach and consequent lowering of the grade.

Hay sheds with a wide driveway like that illustrated in figure 5, when not in use for storing baled hay, have served in the humid regions to protect loose hay from injury by rain. A considerable quantity of hay can be moved into the shed from the windrow with two push rakes in a short time if rain threatens. Hay thus brought

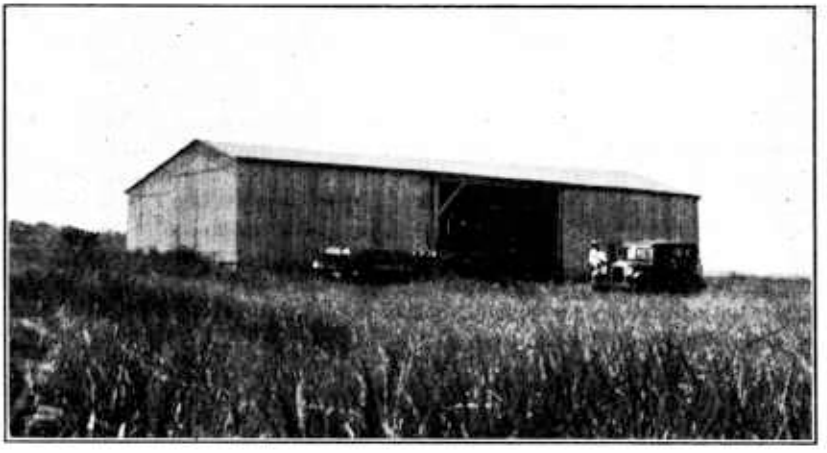

FIGURE 5.—Sheds such as this, if not filled with hay, may be used to protect the haying machinery during the winter

into the shed may be baled during rainy weather when the crew would otherwise be idle. More sheds of this type could be used to advantage in humid districts.

STACKING JOHNSON HAY

Most hay dealers and some growers believe that a better average grade would be obtained if the hay were stacked and allowed to go through the sweat before it is baled. It is possible that the increased premium obtainable for the better grades under United States standards will induce a larger percentage of the producers to stack their hay.

There is considerable variation in the practices of producers who stack their hay, as regards curing the hay before stacking, methods of stacking, and size of stack. Some let the hay cure thoroughly in the swath and windrow and stack direct from the windrow. Others put the hay in cocks before it is thoroughly cured and let it stand for several days before putting it in the stack. The latter method

usually results in hay of a better color and is a safer practice to follow in unsettled weather, but it requires considerably more labor than stacking from the windrow. In good weather when hay may be safely stacked direct from the windrow the saving in labor will usually more than offset any gain in quality of hay that might result from cocking before stacking.

In stacking some use a stacker and put the hay up in stacks containing 10 to 15 tons each, while others stack by hand in small stacks of 2 to 3 tons each. The latter practice is the more common. One reason for this is that there are but few stackers in use in the Southeast, and where hay is pitched to the stack by hand it is impracticable to build large stacks. Many have never used stackers and are reluctant to invest money in equipment with which they are unfamiliar, and especially at a time when market conditions are unsatisfactory. Furthermore, many are of the belief that hay will not keep well in a large stack. There appears to be no real foundation for this belief, for if the hay is well cured and the stack properly built hay will keep as well in a large stack as in a small one, and there is much less waste.

The most common method of putting up hay in small stacks calls for a crew of four men and one team. One man and team with a push rake deliver the hay to the stack, one man builds the stack, and two men pitch the hay to the man on the stack. Such a crew will normally stack about 12½ tons a day, or about 3.12 tons per man per day. Some producers vary this method and build a larger stack by placing a wagon with a hayrack at the side of the stack when the stack has been built up as high as a man can pitch from the ground, and one man then pitches the hay to the wagon and the other pitches it from the wagon to the stack. This is an expensive and inefficient practice, as it is wasteful of labor and reduces the quantity of hay stacked per hour per man. Many producers make a practice of building three stacks in a group, so that all may be baled at one setting of the press. The three stacks are built at the same time, the crew consisting of two pitchers and a stacker to each stack and two men with push rakes to deliver the hay to the stack. Grouping the stacks in this manner is the most efficient method of handling Johnson hay where small stacks are used. It enables two push rakes to keep three stacking crews busy and permits of baling from 6 to 8 tons at one setting of the press, whereas only one-third of this quantity may be baled at a setting if the stacks are placed singly.

Where a stacker is used on hay that is properly cured, the hay can be put up in well-built stacks of 10 to 15 tons each and allowed to go through the sweating or fermenting process before being baled. Such hay will not go out of condition and stands little or no danger of heating while in transit or in storage. Another thing in favor of large stacks is that a much smaller percentage of the hay is exposed to the weather, hence the amount of weather-damaged hay will be proportionately less.

Putting hay in large stacks with push rakes and a stacker also permits of a more efficient use of labor than when it is put up by hand in small stacks. (See title-page illustration.) A crew of 3 men and 2 teams—with 1 man on the push rake, 1 on the stack, and 1 operating the stacker—will usually handle slightly more hay than will a crew of 4 men and 1 team where the hay is pitched to the

stack by hand, and a crew of 4 men and 2 push rakes will stack approximately twice as much as a hand-stacking crew of 4 men and 1 team.[3] The latter is probably the most efficient sized crew to use with a stacker, especially where the hay is moderately heavy. Where the hay is exceptionally heavy it is sometimes necessary to use two men on the stack.

Occasionally the tops of newly built stacks are blown off by a sudden storm, and when this is accompanied or followed by rain considerable damage is likely to result. Stacks that have been properly built and had time to settle will withstand considerable wind and are not materially damaged by rain. Wires with weights attached to each end when placed over the stack will usually keep the tops from blowing off. Some farmers make a practice of topping out the stacks with freshly cut grass or heavy, partly cured hay. When this is done the stack settles more quickly and the top is less likely to be blown off.

One objection offered to stacking in general, and particularly where the hay is put up in large stacks, is that frequently a considerable quantity of hay in the bottom of the stack will be damaged by absorbing moisture from the ground or by water from a heavy rainfall running under the stack. This trouble may be obviated to some extent by care in choosing the highest and driest ground for the stack site. Where the hay is put up in large stacks a permanent stack site may be selected, and a layer of poles placed under the stack will keep the hay from coming in close contact with the ground and materially reduce the damage from this source.[4]

YIELDS AND QUALITY OF HAY

It is possible to cut Johnson grass for hay three or four times each year. Frequently, however, the first cutting is too weedy to be marketed and must be used to feed work stock on the farm or burned to get it off the land. In some places east of the Mississippi River, particularly near Augusta, Ga., the narrow-leaf vetch,[5] commonly called native vetch, volunteers in the meadows and is present in considerable quantity at the first cutting. The presence of this legume improves the feeding value of the hay.

Yields per annum on the bottom lands near Augusta, Ga., average 3 to 4 tons per acre. In the Black Prairie Belt of Alabama and Mississippi the yields are somewhat less, usually 1 to 4 tons per acre, depending on the fertility of the soil. This is the approximate yield to be expected on the unirrigated meadows in the vicinity of Waco and Fort Worth, Tex., although there seems to be a higher average in the Texas yields. On the irrigated lands at San Antonio, Tex., a yield of 7 tons of hay is obtained by the best growers, but the average is perhaps between 5 and 6 tons an acre.

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[3] See the following publication: McCLURE, H. B. HAY STACKERS: HOW THEY MAY BE USED IN THE EAST AND SOUTH TO SAVE LABOR. U. S. Dept. Agr., Farmers' Bull. 1009, 24 pp., illus. 1919.

[4] The principal difficulty in putting up hay in large stacks in this area is that there are but few men who know how or have the ability to build a large stack so that it will shed water, and when the work is left to the average laborer the weather damage to hay in large stacks is frequently heavy. Farmers' Bulletin No. 1009, Hay Stackers: How They May Be Used in the East and South to Save Labor, describes various kinds of stackers and how to use them, and also tells where and how to build stacks in order to avoid loss. This bulletin will be sent free on request to the United States Department of Agriculture.

[5] *Vicia angustifolia.*

On less productive soils in any of the sections just mentioned, unirrigated meadows seldom produce more than 1 ton per acre, and usually only one or two cuttings are made. This fact must be considered by those who are thinking of undertaking the production of Johnson hay on their farms. Unless they have proper soil and climatic conditions, such as exist in the localities now engaged in growing this grass for hay, it will rarely be found profitable to seed a meadow.

From a grading standpoint the average quality of the Johnson hay produced in Mississippi, Alabama, and Georgia is rather low. Much of this hay is discolored or bleached by the sun, and often there is a high percentage of other grasses or foreign material which lowers its market value. In order to produce hay that will grade high, it will be necessary to renovate the meadows oftener and use more care in curing to retain the bright-green color so desirable in market hay.[6]

The hay produced at San Antonio, Tex., especially on irrigated meadows, is excellent in both color and purity. Hay from the unirrigated meadows in this locality lacks somewhat in purity but has a good color, because the weather conditions during the summer are almost ideal for curing. Around Waco and Fort Worth, Tex., the hay often is brighter than that produced in States farther east, but it sometimes contains considerable foreign material. On the whole, there is room for much improvement in the quality of Johnson hay.

MARKETS AND PRICES

The markets for Johnson hay are confined almost entirely to the Cotton Belt. Very little of this hay is ever shipped to markets in the Northern States, as there is usually a surplus in those States of hay of a kind and grade preferred by consumers in that territory. Freight rates are also disadvantageous for the movement of southern hay into the northern markets. Feeders in the Cotton Belt recognize the high nutritive value of Johnson hay and in some instances would prefer it to timothy if a uniformly good grade of hay could be obtained and the danger of infesting their cultivated farm land with Johnson grass were not always present.

The prices for Johnson hay are rarely, if ever, so high that it is found profitable to ship the hay any considerable distance to market, which makes it advisable to produce Johnson hay for market only where there is a sufficient demand at relatively close markets to absorb the surplus.

The price of Johnson hay is usually less than that paid for a comparable quality of timothy or alfalfa in the same market. There is usually little difference, however, in the prices of good native or prairie hay and Johnson hay.

FEEDING VALUE

Stockmen in the Cotton Belt are practically agreed that Johnson hay has a higher feeding value than timothy hay. If a uniformly

[6] CROSBY, M. A. PREPARING JOHNSON HAY FOR MARKET IN THE BLACK PRAIRIE BELT OF ALABAMA AND MISSISSIPPI. U. S. Dept. Agr. Farmers' Bul. 1574, 24 pp., illus. 1928.

high grade of this hay could be obtained, there would be very little dissatisfaction with its feeding value. Most of the complaints arise from the fact that there is so much poor Johnson hay on the markets. Where Johnson grass is allowed to stand until the seed ripens, it becomes unpalatable, because it is coarse and stemmy. Other causes, such as weeds and leaching by frequent rains during the curing period, affect adversely the feeding value. Timothy is better cared for on the average, and this results in the impression among many feeders that it is a better hay.

Several feeding tests have been conducted at State agricultural experiment stations, and these indicate that Johnson hay has a rather high value for work animals but is not very good for dairy cattle. At the Mississippi Agricultural Experiment Station [7] separate lots of mules were fed Johnson, timothy, Bermuda, Lespedeza, and alfalfa hays. In addition to the hay, sufficient oats and corn and cob meal were added to balance the rations. The mules received equal quantities of grain feed and equal portions of hay. All remained in good condition throughout the 89 days that the experiment lasted, but those fed alfalfa hay made the largest and cheapest gains. The mules receiving alfalfa hay gained nearly twice as much as those fed Bermuda hay; however, those fed Johnson hay made slightly greater gains than those on timothy or Bermuda hay. The cost per pound of gain for those fed Johnson hay was 36 cents; Bermuda, 37 cents; timothy, 48 cents; Lespedeza, 27 cents; and alfalfa hay, 21 cents.

In another feeding test at the Mississippi station [8] Johnson hay was compared with corn silage and cottonseed hulls as a feed for dairy cows. Under the conditions of the experiment 20 pounds of silage were equal to 6 pounds of Johnson hay, and 12 pounds of cottonseed hulls to 10 pounds of hay.

The Alabama Agricultural Experiment Station [9] also conducted a feeding test with beef cattle. The steers that were fed a ration consisting of cottonseed meal, cottonseed hulls, and silage made a daily gain of 1.86 pounds per head at a cost of 7.98 cents per pound; those fed a similar ration in which Johnson hay replaced the silage made a daily gain of 1.43 pounds at a cost of 11.88 cents a pound.

The bulletin mentioned in footnote 9 discusses an experiment in wintering steers in which a ration of cottonseed meal and cottonseed hulls was compared with one in which a part of the hulls in the ration was replaced by Johnson hay. The daily gain made by the steers on the first-named ration was 0.64 pound per head, whereas those given Johnson hay gained only 0.59 pound a day.

The composition and digestibility of Johnson hay compare favorably with those of other grass hays, as shown in Table 1. It is, however, much less valuable than the legume hays. The percentages of protein, carbohydrates, and fat that are digestible provide a better index to the actual feeding value than the composition alone.

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[7] LLOYD, E. R. JOHNSON GRASS HAY. *In* Wallace's Farmer, vol. 40, p. 1523. 1915.

[8] MOORE, J. S. FEEDING EXPERIMENTS. *In* Miss. Agr. Exp. Sta. 15th Ann. Rept., pp. 23–26. 1902.

[9] GRAY, D. T., and WARD, W. F. STEER FEEDING IN ALABAMA. Ala. Agr. Exp. Sta. Bul. 163, pp. 57–133, illus. 1911.

TABLE 1.—*Average composition and percentages of digestible nutrients in the dry matter of Johnson and some other hays* [1]

Kind of hay	Ash	Crude protein	Carbohydrates		Fat, or ether extract	Digestible protein	Digestible carbohydrate equivalent
			Crude fiber	Nitrogen free extract			
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Johnson grass	6.8	7.9	28.7	42.0	2.6	3.5	45.5
Sudan grass	7.5	9.0	25.9	44.0	1.6	4.5	41.1
Timothy	5.4	6.8	28.5	44.6	2.7	3.3	45.0
Millet	7.7	8.7	26.5	42.5	2.6	5.2	50.3
Alfalfa	8.5	15.4	26.0	35.6	2.5	11.0	40.3
Cowpea	12.6	17.0	20.0	35.7	2.7	11.6	36.0

[1] The analyses and digestible nutrients were compiled by the Miscellaneous Laboratory, Bureau of Chemistry, and the Animal Husbandry Division, Bureau of Animal Industry. As the original average analyses varied from 5.3 to 12.5 per cent of moisture, the percentages of crude nutrients and digestible nutrients have been calculated on the basis of each hay having 12 per cent of moisture. The carbohydrate equivalent shown in the last column of the table is the sum of the digestible crude fiber and nitrogen-free extract, plus 2.25 times the digestible fat.

WEEDS AND THEIR CONTROL

Various grasses, legumes, and weeds become abundant in Johnson-grass meadows, especially in the humid portion of the Cotton Belt, if the meadow is not plowed or otherwise cultivated at intervals of two to five years. Some of the grasses and legumes are of considerable value as hay plants, whereas others are entirely worthless.

Among the grasses found in the meadows of Georgia, Alabama, and Mississippi which have more or less forage value are Dallis grass, field paspalum, Vasey grass, yellow foxtail, crabgrass, several species of Panicum, and Bermuda grass. Of these, Dallis grass, or large water grass, is perhaps the most valuable, because it not only makes good hay but is also a valuable pasture grass. None of the grasses named, however, are equal to Johnson grass in productiveness, and their presence is harmful, because it results in lower yields and ordinarily a poorer quality of hay. Grasses which are found in Johnson-grass meadows and are of little or no forage value are the hair grass, smut grass,[10] marsh broom sedge or bushy beardgrass,[11] and silver-top beardgrass.[12] These grasses are rather common in some of the poorer meadows near Montgomery, Ala., and are usually accompanied by large numbers of miscellaneous weeds. Under such conditions the meadow is decidedly unprofitable.

In the group of legumes that occur in Johnson-grass meadows there are several that are useful hay plants, but these also tend to lower the yields and, except in the case of Lespedeza, the selling price of the hay. Lespedeza, black medic, and narrow-leaf vetch, better known in the Southeastern States as native vetch, are the most common of these legumes. Hairy vetch is often sown on the meadow when it is first plowed, and after it once becomes established it volunteers for several years from the shattered seed, making most of its growth during the winter months, when Johnson grass is more or less dormant. The vetches make a good palatable hay of high feeding value but produce only one cutting a year, and because they delay the first cut-

[10] *Sporobolus indicus.* [11] *Andropogon glomeratus.* [12] *Andropogon saccharoides.*

ting of Johnson grass they are considered by many farmers as undesirable, although not otherwise especially objectionable. The crop of vetch hay or vetch and Johnson hay mixed is usually retained to feed the farm livestock.

Lespedeza, or Japan clover, is found in the meadows from the Atlantic coast west to Texas, but is most abundant in Mississippi. Johnson grass and Lespedeza mixed make a splendid hay, especially for dairy cows, and this mixed hay often sells at a premium over the straight Johnson hay.

On the black limestone soils of Alabama and Mississippi, where much Johnson grass is produced, sweet clover occurs to a limited extent in many of the meadows and would be a valuable addition to the Johnson hay if the first cutting were made when the sweet clover is ready to cut. This is not often done, however, and the coarse stems of sweet clover lower the grade of the hay when it is brought to the market.

In addition to these rather beneficial legumes, a species of Glottidium [13] and the partridge pea [14] are often found in meadows. Both of these are undesirable from a hay standpoint, and except for what little good they do the soil by the addition of nitrogen they add nothing to the crop and should be suppressed by every means possible.

Of the weeds that are found in the Johnson-grass meadows of the Southeastern States, the bitterweed or sneezeweed,[15] ironweed,[16] coneflower,[17] thoroughwort,[18] horsemint,[19] erect or spotted spurge,[20] and sedges or galingale [21] are the most troublesome. Broom sedge is a grass and is found on the upland, but the true sedges and the rushes are present only on wet or poorly drained soils.

In Texas, weeds are not nearly so troublesome as in the States farther east. On the irrigated meadows there is little difficulty with weeds. When irrigation of the meadows is not practiced crab grass, switch grass, and weeds like the coneflower and ironweed are sometimes present in sufficient quantity to affect seriously the grade of the hay.

As indicated previously in the discussion of how best to maintain the productivity of a meadow, breaking up and cultivating the land at frequent intervals is the best method for controlling the weeds as well as the invading grasses and legumes. A meadow that has been plowed every year or even every second year will never be troubled by weeds, and plowing every three to five years will keep the weeds out in most cases. Good drainage is also essential. If there are spots in the field that are wet and soggy, cultivation alone will not prove sufficient.

VALUE IN ROTATIONS

Johnson grass is rarely, if ever, included in a regular rotation system with other crops. This is because of the tenacity with which it holds on to the soil and the consequent difficulty of getting rid of

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[13] *Glottidium versicarium.*
[14] *Chamaecrista fasciculata.*
[15] *Helenium tenuifolium.*
[16] *Vernonia maxima.*
[17] *Rudbeckia* sp.
[18] *Eupatorium serotinum.*
[19] *Monarda dispersa* (?).
[20] *Euphorbia preslii* or *Chamaesyce preslii.*
[21] *Cyperus ferax.*

it in time so that another crop can be grown on the land. Alternating Johnson grass with winter oats in the same season can scarcely be called a rotation. The combination of winter oats and hairy vetch in the winter and Johnson grass in the summer has been used by a few farmers with satisfactory results but is not generally practiced.

A four-year rotation with Johnson grass three years and corn one year would result in much-improved meadows and fewer weeds. The profits from such a rotation, of course, would depend on the suitability of the soil for corn production, but usually the soil where Johnson grass thrives is good cornland. A regular rotation such as this would no doubt prove profitable from the standpoint of larger yields and better quality of hay, even if the corn were grown at a loss on account of the extra labor required for its cultivation. Unless unusual efforts are made to subdue the Johnson grass, there are always enough plants remaining in the cornfield to reestablish the meadow promptly when the corn crop is removed.

Most of the growers in Georgia and Alabama do not consider that Johnson grass has any marked beneficial effect on the following crops through the decay of the underground stems and roots. This claim has been made more often in Texas than in other States.

MIXTURES WITH COWPEAS AND SOY BEANS

If a Johnson-grass meadow is plowed in the spring and seeded to cowpeas or soy beans, the grass will come back and grow intermixed with the legumes. This produces at the first cutting a mixed hay which has a very high feeding value. Such mixtures may be obtained on land not already set to Johnson grass by sowing 15 pounds of Johnson-grass seed and 60 pounds of cowpeas or soy beans on a well-prepared seed bed in the late spring. Such a mixture of Johnson grass and cowpeas produced 2.8 tons per acre of cured hay at the Arlington Experiment Farm, near Washington, D. C., in 1912. (Fig. 6.) Soy beans with Johnson grass will do fully as well if the proper varieties are chosen.

Mixed hays, such as those just mentioned, can be sold to better advantage to local dairies than on the regular city markets, where mixed hays of this character are nearly always discriminated against.

FEED RESERVES FOR LIVESTOCK IN DRY REGIONS

In Arizona, New Mexico, and southwestern Texas there is often need of some crop which will save the range cattle from starvation in periods when there is a shortage of pasture. This often happens in years of excessive drought. It has been found in Arizona that there are numerous drainage courses opening out of the mountains, where the land at the mouth of the valley is subject to overflow at least once a year. Johnson grass once established on these deltas or overflow areas becomes permanent and provides hay which may be used by the rancher to carry his cattle through periods when feed on the range is inadequate. More of these favorable areas should be fenced and used to produce Johnson hay.

LAWS AFFECTING PRODUCTION AND SHIPPING OF HAY

A survey of the laws of Southern States which relate to the production and shipping of Johnson hay has been made.[22] Very few of these States have any laws on this subject, although several which have none affecting the hay have laws restricting the sale of Johnson-grass seed. So far as can be learned, Alabama, Arizona, Arkansas, Florida, Georgia, Louisiana, New Mexico, North Carolina, South Carolina, Texas, and Virginia have no laws governing the production or movement of Johnson hay.

Mississippi requires a permit from its State plant board before any hay can be shipped into the State. This ruling was made primarily to prevent the importation of hay from sections infested with

FIGURE 6.—Johnson grass and cowpeas on the left; Sudan grass and cowpeas on the right. Photographed at the Arlington Experiment Farm, near Washington, D. C., 1912

the alfalfa weevil and the Mexican bean weevil and so far as known has never been applied to shipments of Johnson hay.

Tennessee has a law which prohibits any person bringing into the State, selling, offering for sale, or giving away the seeds or plants of Johnson grass, and the law is strictly enforced, it is claimed. This practically prohibits traffic in Johnson hay in that State.

The Oklahoma law makes it illegal to sell Johnson-grass seed or to allow seed to mature in the State. It also provides against giving away, selling, or transporting hay intermixed with seeds. This law is in the compiled Oklahoma statutes for 1921. It is necessary to have an inspection before any shipment of Johnson hay is made, to determine that it does not contain any seeds, and because of the difficulty in securing such inspection little shipping is done.

[22] The digest of information concerning this feature of Johnson-hay production was supplied by K. B. Seeds, marketing specialist of the Bureau of Agricultural Economics, United States Department of Agriculture.

The California law makes it illegal for any person owning, controlling, leasing, or possessing land in the State knowingly to permit Johnson grass to mature and disseminate its seed on such land, or for any person knowingly to sow or disseminate, or cause to be sown or disseminated, any seed of Johnson grass upon any land owned or possessed by another, or along any roadway, highway, or right of way for ditch purposes. This law, like that of Oklahoma, makes the shipping or transportation of Johnson hay practically impossible.

PASTURE

Johnson grass would appear to be eminently fitted for use as pasture. Its rhizomes, or underground rootstocks, provide for a continual supply of new plants; thus, even if the old plant did not possess the ability to renew its growth when it was cut or grazed off, there would be new foliage for animals to feed on. There is no trouble, either, regarding its palatability, all classes of livestock relishing it, particularly before it has headed and become stemmy.

Notwithstanding these advantages Johnson grass is not a good pasture plant. When heavily grazed it weakens and gives way to other grasses and weeds, and even if the stand is maintained the growth is less and less until it becomes unprofitable. As in the case of hay meadows, a pasture should be plowed every third or fourth year.

CARRYING CAPACITY

The aftermath of Johnson-grass meadows will usually furnish pasturage for two mature animals per acre from one to three months after the last cutting of hay is removed. If the soil is fairly rich, land devoted exclusively to Johnson-grass pasture is capable of carrying one mature animal per acre for nine months. There are very few farmers in the Southeastern States, however, who depend on Johnson grass exclusively for pasture, on account of its tendency to "run out" and become less and less satisfactory. This progressive deterioration of Johnson-grass pastures is not quite so marked in Texas and other Western States, where weeds and other grasses are not so numerous or aggressive and therefore do not invade the pasture so quickly.

Many farmers who are situated outside those areas where Johnson grass thrives conclude that it will make an excellent pasture on thin poor soil where other grasses have failed. They are usually disappointed when they sow the seed under such conditions, finding that the grass makes a weak growth and provides but little pasture.

EFFECT OF PASTURING MEADOWS

Johnson-hay growers who are not provided with facilities for irrigating their meadows are almost a unit in believing that pasturing even in a very limited way injures the meadow. Most of them prefer to do without the pasture in order to preserve the yielding capacity of their meadows. On the other hand, the irrigated meadows near San Antonio, Tex., are pastured regularly with few bad effects.

Pasturing Johnson grass apparently causes the rootstocks to be smaller and to form near the surface. Therefore they do not provide

as much food reserve as usual and are more subject to injury from low temperatures, drought, etc. Weeds and grasses invade the pastured meadows in greater numbers than those not pastured. Dallis grass, Bermuda grass, and crab grass are all injured less by pasturing than Johnson grass and therefore tend to become more abundant each year in the meadows which are pastured. Dallis grass and Bermuda grass make better permanent pastures than Johnson grass but are less productive as hay.

PASTURING OR FEEDING THE ROOTSTOCKS

An old Johnson-grass meadow has a large quantity of feed in the rootstocks found in the soil in which it is grown. (Fig. 7.) These

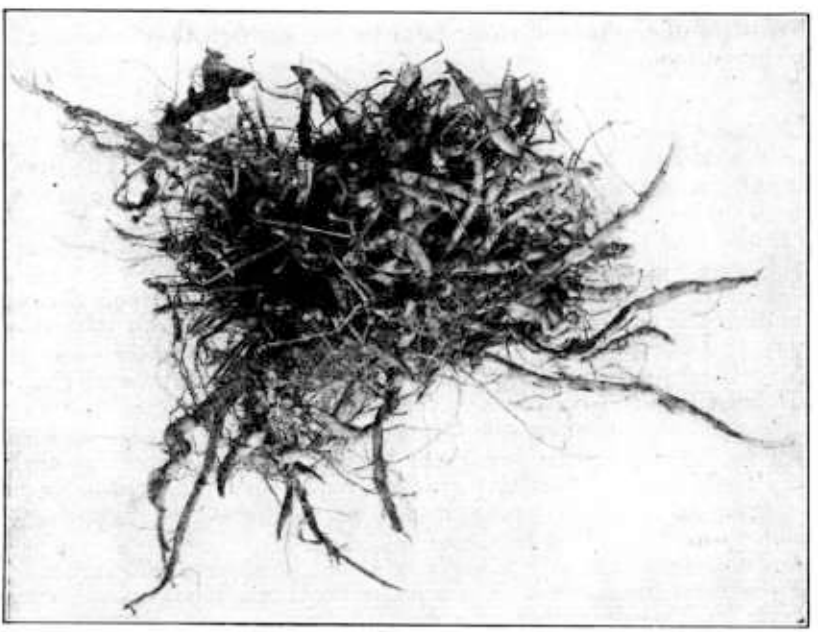

FIGURE 7.—A vertical view of a Johnson-grass plant, showing an unusual development of rootstocks, or underground stems

rootstocks are relished by nearly all kinds of livestock, but particularly by hogs and cattle. In order to make this supply of feed available, the meadow must be plowed and the rootstocks exposed. Hogs and cattle will follow the plow and pick up these rootstocks if allowed to do so, and a considerable number of animals may be maintained in this way.

Plowing a field of Johnson grass and pasturing the roots very seldom destroys the meadow, because there are usually enough rootstocks left in the soil to reestablish the grass; in fact the growth is usually more luxuriant the following year than on meadows which have not been plowed. The use of a meadow in this manner during a drought period, when other feed is scarce, has been practiced in western Texas. It is claimed that cattle can be carried through the winter at a cost of only $5 a head by this method.

PRUSSIC-ACID POISONING

In common with other plants allied to the sorghums, Johnson grass when green contains small quantities of the cyanogenetic glucoside which is responsible for the poisoning of cattle when they feed on the immature green plants of the sorghum. Cases of poisoning from eating this grass are very rare; in fact, almost unknown. Two or three fatalities among cattle pasturing on Johnson grass have been reported from South America and one recently from Kansas, but this grass has been pastured for years in the Southern States without any trouble from prussic-acid poisoning. It therefore seems practicable, except in cases of extreme drought, to disregard the slight possibility of poisoning and to pasture Johnson grass freely whenever other conditions recommend the practice. Where the grass has been injured by drought, it is much more likely to contain sufficient quantities of the poison to be fatal to cattle when they consume it in the green state.

SEED PRODUCTION

Johnson grass produces seed in abundance, and it can be harvested easily either with a grain binder or a mower and rake. The greatest difficulty in saving a Johnson-grass seed crop is due to the ease with which the seeds shatter when even approximately mature. A decision as to the best time for harvesting a seed crop is difficult, because the grass does not mature uniformly and the early heads will have lost most of their seed before the bulk of the crop is ripe. Notwithstanding the loss of this seed, it will usually be found desirable to delay the harvest until the early heads begin to shatter their seed. This will approximate the time when a large percentage of the crop is in condition to save for seed.

The seed threshes out easily, and this operation can be performed with an ordinary grain separator by using special sieves or screens. Very little seed of Johnson grass is required by the trade, because the grass is so nearly spontaneous in its habits of renewing old meadows and invading new areas.

Germination is nearly always retarded in a certain percentage of the Johnson-grass seeds, as it is in the hard seeds of clover and alfalfa.[23] This dormancy of a part of the seeds adds to the difficulty of eradicating the grass, because these dormant seeds will germinate and produce new plants for several years after their production by the seed plant. Much of the discouragement attending the eradication of this grass from a cultivated field arises from this seed character.

The accepted weight in the trade of a bushel of Johnson-grass seed varies from 25 to 28 pounds, but good clean seed has been found to weigh 32 to 36 pounds per bushel. Very few States have established a legal weight for a bushel of this seed.

USE AS ANNUAL HAY GRASS IN THE NORTH

Numerous inquiries are received relative to the value of Johnson grass in States north of the Cotton Belt. The desire to try it is

[23] HARRINGTON, G. T. GERMINATION AND VIABILITY TESTS OF JOHNSON GRASS SEED. *In* Proc. Assoc. Offic. Seed Analysts No. America, 1916–17, pp. 24–28. 1917.
——— FURTHER STUDIES OF THE GERMINATION OF JOHNSON GRASS SEEDS. *In* Proc. Assoc. Offic. Seed Analysts No. America, 1916–17, pp. 71–76. 1917.

based on information which has been acquired by personal observation of the grass in the South or through newspaper reports of its general aggressiveness and ability to sustain itself without cultivation or other assistance. The usual impression among correspondents of the Department of Agriculture is that the grass will grow successfully on poor thin soils and protect hillsides from erosion, while furnishing pasture or hay in greater abundance than the grasses they are accustomed to grow. This idea of the value of Johnson grass in these States is entirely erroneous.

As indicated previously, Johnson grass ordinarily is not perennial north of latitude 38°, but it has been known to live over winter in southern Iowa,[24] 175 miles north of that line. There are not many instances, however, of its being perennial that far north, and in that section it is probable that fall plowing and consequent exposure of the rootstocks to frosts would kill the grass completely.

Where the grass does winterkill, it must of course be considered as an annual and be able to compete with Sudan grass and millet, both of which ordinarily make larger yields of hay than Johnson grass under such conditions. Possibly two cuttings a season (but usually only one) are the most that can be obtained from Johnson grass when it behaves as an annual. It can not therefore be recommended as a hay grass for the Northern States in preference to Sudan grass, which makes an equally good quality of hay and a yield at least 25 per cent larger.

The fact that Johnson grass requires a rich soil is another source of disappointment to prospective growers in the North. Most of them are satisfied to grow timothy, clover, or alfalfa when they are able to devote good land to hay production. It is only when they have allotted an unproductive part of their farm to the hay crop that they become dissatisfied with these splendid hay plants and begin to look for something new. Johnson grass is even more unsatisfactory on poor thin soil in the Northern States than in the Cotton Belt.

HYBRIDS OF JOHNSON GRASS AND SORGHUM

Natural crosses between Johnson grass and sorghum are not numerous, and artificial crosses between these two crop plants are rather difficult to make. Selections from the progeny of natural hybrids have been offered to the public under such names as "Johnsorgo" (fig. 8), "Amber hay," and "Ham grass." These hybrids are usually larger and more vigorous in their growth than Johnson grass but not so difficult to eradicate. Some selections have rootstocks and others do not. Where present, these rootstocks are usually shorter but larger in diameter than true Johnson-grass rootstocks.

Extravagant claims have been made for several of the crosses, but none of them have proved sufficiently good to win a permanent place in our list of forage grasses. The yield of hay per cutting is much larger than that of Johnson grass, but there is usually but one cutting in a season, and the hay is coarse and not relished so much by livestock. Sudan grass is preferable to most of these crosses in

[24] PAMMEL, L. H., and KING, C. M. JOHNSON GRASS AS A WEED IN SOUTHWESTERN IOWA. Iowa Agr. Exp. Sta. Circ. 55, 4 pp., illus. 1919.

the quality of hay produced, and the yields are usually about as large.

JOHNSON GRASS AS A WEED

Probably no other grass with the inherent forage value possessed by Johnson grass has been so universally condemned, owing primarily of course to its aggressiveness and the accompanying difficulty of eradication, but also to the fact that it is abundant in a part of the United States where the system of farming encourages trouble from such a grass. Johnson grass invades cultivated fields and flourishes there, because cotton is produced very largely by tenant farmers who are rarely sufficiently thorough in their cultivation of

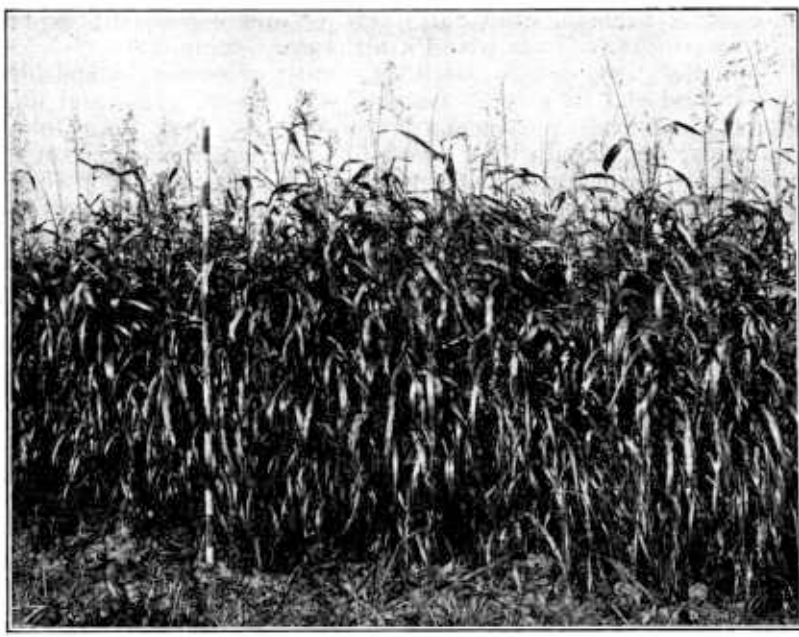

FIGURE 8.—"Johnsorgo," a cross between Johnson grass and Honey sorgo. This hybrid grew to a height of 9 feet in cultivated rows, but was not nearly so coarse stemmed in the broadcast or drilled plots

the fields to destroy the grass completely. When cultivation of a field stops short of complete destruction of the grass, it merely stimulates the remaining plants to make a stronger growth. Scattered throughout the Cotton Belt are those who have shown that it is possible to control the grass, but these are always the better type of farmers who believe in thorough cultivation of their crops regardless of weed troubles. A method of eradicating Johnson grass has been fully described in Farmers' Bulletin 1537.[25]

It is extremely doubtful, in view of the expense connected with the eradication of this grass, whether anyone is ever justified in

[25] TALBOT, M. W. JOHNSON GRASS AS A WEED. U. S. Dept. Agr. Farmers' Bul. 1537, 10 pp., illus. 1928. This publication may be obtained on request from the United States Department of Agriculture, Washington, D. C.

sowing Johnson grass on the better soils in the Southern States. When seeded north of the thirty-eighth degree of latitude it can be killed out with little effort and expense, but other grasses are better suited to that part of the United States and are more profitable to produce.

It is intended by this bulletin only to indicate the best methods of utilizing Johnson grass where it is already established, and not to encourage in any way its spread to new areas.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

July 5, 1929

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Division of Farm Management and Costs	H. R. TOLLEY, *Assistant Chief of Bureau, in Charge.*

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